

5-9 Complex Numbers

$$\sqrt{-1} = i$$

$$i^2 = -1$$

Simplify.

$$\begin{array}{llll} \sqrt{-5} & \sqrt{-25} & \sqrt{50} & \sqrt{-28} \\ i\sqrt{5} & 5i & 5i\sqrt{2} & 2i\sqrt{7} \end{array}$$

$$i^{17}$$

$$i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i \cdot i$$

$$i \cdot (i^2)^8$$

$$i \cdot (-1)^8$$

$$i \cdot 1$$

$$i$$

$$i^{46}$$

$$(i^2)^{23}$$

$$(-1)^{23}$$

$$-1$$

Multiplication

ex:

$$-3i \cdot 2i$$

$$-6i^2$$

$$-6(-1)$$

$$6$$

Must simplify 1st!

ex:

$$\sqrt{-12} \cdot \sqrt{-2}$$

$$i\sqrt{12} \quad i\sqrt{2}$$

$$2i\sqrt{3} \quad i\sqrt{2}$$

$$2i^2 \cdot \sqrt{6}$$

$$\boxed{-2\sqrt{6}}$$

ex:

$$\sqrt{-4} \cdot \sqrt{-25}$$

$$2i \quad 5i = 10i^2$$

$$-10$$

Add and Subtract

ex:

$$\sqrt{-3} \cdot \sqrt{-27}$$

$$\sqrt{-16} - \sqrt{-49}$$

$$4i - 7i$$

$$\boxed{-3i}$$

ex:

$$i\sqrt{2} + 3i\sqrt{2}$$

$$4i\sqrt{2}$$

Solve.

$$5y^2 + 20 = 0$$

$$5y^2 = -20$$

$$\sqrt{y^2} = \sqrt{-4}$$

$$y = \pm 2i$$

Cannot leave i in the denominator

$$\frac{2}{3i} \cdot \frac{i}{i}$$

$$\frac{2i}{3i^2} = \left(\frac{2i}{-3} \right)$$

ex:

$$\frac{6}{\sqrt{-2}} = \frac{6}{i\sqrt{2}} \cdot \frac{i\sqrt{2}}{i\sqrt{2}}$$

$$\frac{6i\sqrt{2}}{2i^2} = \frac{6i\sqrt{2}}{-2}$$

$$-3i\sqrt{2}$$

Complex Numbers

binomial $a + bi$ where $a, b \in \mathbb{R}$

ex: $3 + 4i$

monomial

$6 + 2i$ $7 - 4i$

Pure imaginary number
 bi where $b \neq 0$

ex: $\sqrt{-3} = i\sqrt{3}$
 $5i$

ex:

$$(3 + 6i) + (4 - 2i)$$

$$7 + 4i$$

ex:

$$(3 + 6i) - (4 - 2i)$$

$$-1 + 8i$$

ex:

$$(3 + 4i)(5 + 2i)$$

$$15 + 6i + 20i + \cancel{8i^2} - 8$$

$$7 + 26i$$

ex:

$$(8 + 3i)^2$$

$(a+b)^2 = a^2 + 2ab + b^2$

$$64 + 48i + -9$$

$$\underline{55 + 48i}$$

ex:

$$\frac{(4 - 3i)}{(2 - 4i)} \cdot \frac{(2 + 4i)}{(2 + 4i)}$$

$$\frac{8 + 16i - 6i + 12}{4 + 16} = \frac{20 + 10i}{20}$$

$$= \underline{\underline{\frac{2 + i}{2}}}$$

"Fun with Factoring"

$$x^2 + 8$$

$$(x + 2i\sqrt{2})(x - 2i\sqrt{2})$$

$$-4i^2 \cdot 2$$

$$x^2 + 8$$

Hw
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